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LADEE UVS (UltraViolet Visible Spectrometer) and the Search for Lunar Exospheric Dust: A Detailed Spectral Analysis

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Abstract Text:

The Lunar Atmosphere and Dust Environment Explorer (LADEE) executed science observations in lunar orbit spanning 2013-Oct-16– 2014-04-18 UT. LADEE's Ultraviolet/Visible Spectrometer (UVS) studies the composition and temporal variations of the tenuous lunar exosphere and dust environment, utilizing two sets of optics: a limb-viewing telescope, and a solar-viewer. The limb-viewing telescope observes illuminated dust and emitting gas species while the Sun is just behind the lunar limb. The solar viewer, with its diffuser, allows UVS to also stare directly at the solar disk as it approaches the limb, sampling progressively lower exosphere altitudes.

Solar viewer "Occultation" activities occur at the lunar sunrise limb, as the LADEE spacecraft passes into the lunar night side, facing the Sun (the spacecraft orbit is near-equatorial retrograde). A loss of transmission of sunlight occurs by the occultation of dust grains along the line-of-sight [1, 2].

So-called "Inertial Limb" activities have the limb-viewing telescope pointed at the lit exosphere just after the Sun has set. Inertial Limb activities follow a similar progression of diminishing sampling altitudes but hold the solar elongation angle constant so the zodiacal light contribution remains constant while seeking to observe the weak lunar horizon glow [2,3,4].

On the dark side of the moon, "Sodium Tail" activities pointed the limb-viewing telescope in the direction of the Moon's sodium tail (~anti-sunward), during different lunar phases. Of the UVS data sets, these show the largest excess of scattered blue light, indicative of the presence of small (~100 nm) dust grains in the tail. Correlations are sought between dust in the sodium tail and meteor streams [5] and magnetotail [3] crossings to investigate impact- versus electrostatic-lofting [6]. Once lofted, nanoparticles can become charged and picked up by the solar wind [7,8].

The LADEE UVS Occultation, Inertial Limb, and Sodium Tail spectral datasets provide evidence of a lunar dust exosphere.

[1] Wooden *et al.* 2014, LPSC 45, 2123 [2] Wooden *et al.* (2014) & [3] Colaprete *et al.* 2014, at <http://nesf2014.arc.nasa.gov>

[4] Glenar *et al.* 2011, PSS 59, 1695 [5] Stubbs *et al.* 2014 LPSC 45, 2705 [6] Stubbs *et al.* (2014), PSS 90, 10

[7] Farrell *et al.*, 2012, Icarus 219, 498 [8] Mayer-Vernet *et al.*, 2009, Solar Phys. 256, 463

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